METHOD AND ARRANGEMENT FOR PURIFICATION OF WATER

The present invention relates to a method for cleaning water, especially surface or waste water from buildings or roads, which water is directed to a sludge separator for separating suspended material. The invention also relates to means for carrying out the method.

Cleaning of sewage water from separate buildings or roads or small groups of houses has up til now been effected by a low degree cleaning with sludge separators, such as three compartment septic tanks. The water flows by gravity to the well in which coarse pollution sediment at the bottom of the wells. 1-2 times a year the well is emptied.

One type of sludge separator or septic tank is known from US-A-4997562. The tank shown in this document is divided into a plurality of chambers in which the water to be cleaned is brought from each chamber to the next by means of a overflow valve so arranged that the chamber is filled with water up to a certain level before the water flow over to the next chamber. This is for preventing sedimented sludge to leave with the water. At the end of the separator a filter chamber is provided in which the water is filtered through sand and a fibrous organic material.

AT-B-396921 describes cleaning means in the form of a three compartment septic tank in which the water passes one chamber for sedimenting sludge, one cleaning chamber and one filter bed. To increase the effect of the cleaning chamber, a plurality of walls are arranged so that the water is urged to flow in a loop through the chamber.

AT-363871 describes cleaning means with three or four chambers, namely, a sludge separator, a filter chamber, an aerating chamber and a final sedimenting chamber. In the filter chamber the water passes from the bottom of the chamber up through a biofilter.

Even if the use of sludge separators is an inexpensive and simple measure, the described cleaning measures, in accordance with higher environmental consiousness, are insufficient since they not fully take care of biological material and/or phosphorus and not at all take care of heavy metals, which therefore come with the water to the recipient.

The main object of the invention is therefore to provide a method and cleaning means, which is simple and inexpensive to install and run, but notwithstanding this, result in a high degree cleaning of the water.

This object is achieved by giving the invention the features stated in the following claims.

The invention will in the following be described in more detail in connection with embodiments, illustrated in the drawings, for the effectuation of the method.

Figure 1 illustrates schematically cleaning means according to the invention.

Figure 2 illustrates another embodiment of cleaning means according to the invention.

Figure 3 illustrates a plan view of the means according to figure 2.

Figure 4 illustrates in a larger scale a section through a biostep filter, which may be used in the plants according to figure 1 and 2.

Figure 5 illustrates in a perspective view an altered embodiment of a sorbent chamber.

Figure 6 illustrates a section through the chamber of figure 5.

Figure 7 illustrates a section like in figure 6 of an altered embodiment.

The plant illustrated in figure 1, may for example be used to take care of surface water at roads and the like. The water flows from an existing road embankment 10 or via a conduit 12 in a known way to a sludge separator, such as a three compartment septic tank 14, in which the most coarse particles sediment from the surface water and stay at the bottom of the well. The sedimented material in the well is emptied at regular intervals, for example 1 to 2 times per year. The water from the sludge separator 14 is directed via a conduit 16 to a biostep filter 18 in which a degradation of biological material occurs, which is described in more detail below in connection with figure 4. The filter 18 has a surface of permeable, sintered pure polyethene on which microorganisms are acting. In the filter 18 the water rises through the filter insert to the level of a conduit 20, which directs the water to a pump station 22 in which a, for example, submersible pump 24 pumps the water to a level from which it, via a conduit 26, flows to a sorbent chamber 28 in which the water, via a manifold pipe 30 with nozzles, is spread and sprinkled over a sorbent material which reduces by an ion exchanger process the content of phosphorus and nitrogen of

the water and where appropriate, also heavy metals. The sorbent material may comprise one or more materials, for exampel polonite™, a calcium silicate which is provided on a perforated bottom. The material is exchanged for example once a year and may after the reception of phosphorus and nitrogen be used as soil improvement agent. From the sorbent chamber flows now the high degree cleaned water via a conduit 32 to a recipient, which could be a lake, moss or the like.

The plant illustrated in the figures 2 and 3 has in principle the same structure as the plant according to figure 1, but has a more compact embodiment for use as a smaller sewage plant, for example for separate houses or groups of houses in sparsely-populated areas. The parts comprised in the plant according to figures 2 and 3 have thus obtained the same reference numerals as the corresponding parts in figure 1 with an additional 1 in front of the numeral. Thus, the waste water from a building or a group of houses is directed via a conduit 110 to a sludge separator 114, which for example is of the three compartment septic tank type. The desludged water is thereafter directed via the conduit 116 to the biostep filter of the plant, which filter comprises a compact house 34 divided into three chambers 36, 38 and 40 which comprises biostep filter, pump and sorbent filter respectively. The biostep filter has in this embodiment only a filter insert 42 provided in the filter chamber 36 and the water flows, after the passage through this insert 42, over to the pump chamber 38 where it is pumped by the pump 124 to the upper portion of the sorbent chamber 40 where it via a nozzle 44 is sprinkled and spread over the underlying sorbent material. The sorbent material may thus be a zeolite material or polonite™, as mentioned in connection with the description of figure 1. It is advantagously to stir the material, for example mechanically or by pumping (backflushing) the water through

the material, to prevent clogging of the material and also to improve the cleaning effect. The water may also, instead of be sprayed over the material, be supplied through a conduit at the bottom of the sorbent material and pass upwards through the material to an outlet pipe provided above, which will be described in more detail in connection with figure 7. The cleaned water is directed via the conduit 132 to a recipient.

In figure 4 the bio step filter 18 of figure 1 is illustrated in a larger scale. The water flows into the lower part of the filter chamber 46 from the conduit 16 and rises upwards in the filter chamber by hydrostatical pressure and passes through the cylindrical filters 48. Their cylindrical or pipeshaped filter bodies 48 are of a permeable material, such as sintered pure polyethene , which forms the bottom and walls of the pipe, while the pipe is open upwards. The permeable material is of a type on which, by means of microorganisms, a bio skin may grow to create micro processes without lowering the permeability. The filters 48 lowers in this way BOD-content in waste water and prevent suspended material to reach the following sorbent filter. Thus, at the filters a coating of deposited pollution is formed, which may be flushed clean at regular intervals, for example one to two times a year. The filter bodies 48 are provided, at the top around the opening, with an upper flange 50 with its aid they are sealingly inserted in a plate 52, which in turn, with an inbetween support of a seal 54, rest on a bracket 56 provided around the inner periphery of the chamber 46. The plate 52 is provided with struts 58 with which the insert with the filters 48 may be placed on the ground outside of the well for washing of the filters 48 and which struts 58 are dimensioned in such a way that their weight keeps the plate 52 with the filters 48 pressed against the seal 54 against the pressure of the through flowing water.

For lifting the filter insert out of the well 46, the plate is provided with mountings 60 for a lifting yoke 62, which is provided at the top with a ring 64 for connection to a lifting hook (not shown). The water which comes in through the conduit 16 flows through the permeable mantle surface of the filters 48 while depositing pollution on said surface, as described above, into the inner of the pipeshaped filters and flow out from the opening of the filters 48 above the plate 52 and further to the outlet conduit 20, which leads to the pump station 22.

The sorbent chamber 70 illustrated in figures 5 and 6, which may be inserted instead of the sorbent chamber 28 in figure 1, comprises a concrete bed 72 in which a number of receptacles 74 are provided, which comprises the sorbent material 76 (figure 6), for exampel of the type previously mentioned in connection with figures 1 and 2. As emerges from figure 6, the sorbent material 76 is filled up in the receptacles 74 to a level "h". Above the receptacles 74 is a water supply system provided comprising a central pipe 78 and to this, above every pair of receptacles 74, connected spray nozzle holder 80 for supporting nozzles or spray nozzles 82, whereby the pipe 78 and the holder 80 rest on beam profile 84. The pipe 78 is at its far end closed by a terminal end 86, while the fore end has connection means 88 for connection with a supply conduit for the water, such as the conduit 26 in figure 1. The sorbent material 76 in each receptacle 74 rest at a bottom 90 of a net or trellis-fabric so that the water after passing the sorbent material 76 may run down into a channel 92 arranged under the bottom 90 and from there via an outlet pipe 94 to a recipient.

At the embodiment illustrated in figure 7 of the sorbent chamber, supply pipes 96 for the water are brought down into

the sorbent material 76 with the height h, which pipes open at the bottom of the material. At the supply pipes 96, agitators 98 is journalled, which stir and keep the sorbent material 76 in movement. This may, as mentioned above, be polonite™, whereby the stirring of the material is done to prevent the forming of lumps and also to improve the cleaning effect. After the water has passed through the sorbent material to its upper portion it is directed away via the conduit 100 to a recipient.

As emerges from the above, a method and means according to the invention are provided for taking care of surface and waste water in an effective and inexpensive way even though a high degree cleaning of the water is obtained so that it without impact on the environment may be released to a natural recipient, such as a lake, river or moss. Further, the sludge separated in the sludge separator 14 may after suitable processing, such as composting, be used as soil improving agent and the sorbent material in the sorbent chamber 28, which is a natural material with high phosphorus binding capacity, may likewise be used as soil improving agent as it also easily emits phosphorus again to the vegetation.